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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/574,186 | 03/30/2006 | Didier Pribat | 50060/50006 | 7438 |

57726 7590 06/12/2009

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| EXAMINER | |
|---|---|
| WOLVERTON, DAREN A | |
| ART UNIT | PAPER NUMBER |
| 2813 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 06/12/2009 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/574,186 | PRIBAT ET AL. | |
| | Examiner | Art Unit | |
| | DAREN WOLVERTON | 2813 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *04 March 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-6 and 8-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6 and 8-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 March 2009* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *06/05/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Drawings*

The (replacement) drawings are objected to because in FIG. 4, the aluminum layer 9 on the upper right side of the figure is incorrectly labeled as 5. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application.

Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### *Claim Objections*

Claim 1 is objected to because of the following informalities: “making a nanoporous membrane in thin layer …” should be “making a nanoporous membrane in **a** thin layer ...". Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 20-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

**Regarding claims 20-25,** claim 20 recites the limitation "the single-crystal substrate common to numerous pores". There is insufficient antecedent basis for this limitation in the claim and therefore claim 20 and dependent claims 21-25 are indefinite. For the purposes of this action, the claim will be interpreted as requiring a single crystal substrate common to numerous pores only during the devices construction (and is thus a product by process limitation).

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5, 8-10, and 12-25 are rejected under 35 U.S.C. 102(b) as being anticipated by Iwasaki et al. (US PGPUB 2001/0028872) (*Iwasaki* hereinafter) as evidenced by Nakano et al. ("Effect of electrolysis factors...") (*Nakano* hereinafter).

**Regarding claims 1, 5, and 15,** *Iwasaki* discloses a method comprising making a nanoporous membrane 13 (specifically an anodized film) in a thin layer transferred or deposited (see paragraph [0057] and paragraph [0112]) onto a single-crystal substrate 11 (see paragraph [0072]); depositing (see FIG. 18, and paragraph [0155]), in the nanoporous membrane 13, a metal catalyst 201 suitable for penetrating into at least some of the pores 14 (see FIG. 2) of the nanoporous membrane 13; causing (see paragraph [156]) filamentary structures 202 (specifically carbon nanotubes) to grow on the catalyst 201 in at least some of the pores 14 in the nanoporous membrane 13; preparing the nanoporous membrane 13 in a manner (anodization with pores opened to the underlying substrate, see paragraph [0057] and FIG. 2) suitable for ensuring that the wall of the pores 14 includes a single-crystal zone, and growing at least some of the catalyst 201 epitaxially (by electro-deposition, see paragraph [0155]) on said single-

crystal zone and on the single crystal substrate 11 common to numerous pores 14 (see FIG. 18).

Note that when creating the nanoporous membrane 13 using anodization (anodic oxidation) of aluminum (the same method described in the applicants specification), the resulting structure, and thus the walls of the pores 14, will inherently be comprised of one or more single crystal zones and additionally, in *Iwasaki* (see FIG. 2), the bottoms of the pores 14, which may be considered part of the walls (see claim 5), are open to the underlying single crystal substrate 11. Also note that the electro-deposition method used to form the catalyst will inherently (see *Nakano*, page 47, lines 3-6) form the catalyst by epitaxially growth, at least initially.

**Regarding claim 2,** *Iwasaki*, in paragraph [0068], discloses that the pores of the nanoporous membrane have a calibrated size.

**Regarding claim 3,** *Iwasaki*, in FIG. 2, discloses that the nanoporous membrane 13 is made in a manner suitable for ensuring that it extends substantially in a plane (the x-z plane in the figure, where the z-axis extends from the plane), and the pores 14 are made in a manner suitable for ensuring they are oriented substantially perpendicularly to the plane of the membrane.

**Regarding claim 4,** *Iwasaki*, in FIG. 2, discloses that the nanoporous membrane 13 is made in a manner suitable for ensuring that it extends substantially in a plane (the x-y plane in the figure), and the pores 14 are made in a manner suitable for ensuring they are oriented substantially parallel to the plane of the membrane.

**Regarding claims 8 and 9,** *Iwasaki*, in FIG. 8, FIG. 19, and paragraphs [0074] through [0076], discloses that a layer 81 (a layer of Pt, Pd, Ir, Rh, Os, Ru, or Ni) is made on the single-crystal substrate 82 (see paragraph [0076], note that Iwasaki describes both 82 and 81 as part of substrate 11), prior to transferring or depositing the thin layer 13 onto the single-crystal substrate 82 (see the figures and note that the layer must be deposited before layer 13). While not discloses as forming a diffusion barrier these materials will inherently reduce or prevent the diffusion of silicon into the cobalt by their mere presence (how much depends on the solubility of cobalt in the material and the thickness of the formed layer) and thus are inherently suitable for preventing the catalyst 201, at least in part, from being contaminated by the material constituting the substrate 81.

**Regarding claim 10,** *Iwasaki*, in paragraph [0155], discloses that the catalyst 201 is formed by electro-deposition (a synonym for electroplating).

**Regarding claim 12,** *Iwasaki* further discloses, in paragraph [0156], that the catalyst is annealed after deposition, the broadest reasonable definition of annealing being: 'heating and then cooling'.

**Regarding claim 13,** *Iwasaki* further discloses, in paragraph [0155], ), further discloses that the catalyst comprises cobalt, and therefore the annealing (of the cobalt catalyst) is inherently performed under a magnetic field since cobalt is ferromagnetic and thus possesses an internal magnetic field.

**Regarding claim 14,** *Iwasaki*, in paragraph [0002] and paragraph [0250], discloses that an electronic component is made on the nanoporous membrane.

**Regarding claim 16,** *Iwasaki*, in paragraph [0155], discloses that the catalyst is cobalt which is a transition metal.

**Regarding claim 17,** *Iwasaki*, in paragraph [0156], discloses that the filamentary structures are deposited by chemical vapor deposition.

**Regarding claims 18 and 19,** *Iwasaki*, in paragraph [0087], discloses an alternate embodiment of the invention in which silicon nanorods are formed from a gold catalyst as opposed to the cobalt catalyst 201 and the carbon nanotubes 202.

**Regarding claim 20,** note that the above described method of claim 1, creates a structure with all the limitations of this claim.

**Regarding claim 21,** *Iwasaki* further discloses, in FIG. 26 and paragraph [0233] through paragraph [0236]), an embodiment (which still meets all the limitations of claims 1 and 20 as described in the cited paragraphs) in which a portion of the nanoporous membrane (the left half) constitutes an electrode (filaments 111 are conductive structures) enabling a voltage to be imparted to at least one filamentary structure deposited in another portion of the in another portion of the nanoporous membrane (the structures on the opposite side of the device, note that the whole thing effectively forms a FET).

**Regarding claim 22,** *Iwasaki*, in FIG. 19, discloses that the component lies on a substrate 82 and includes at least one filamentary nanoscale structure 202 extending parallel to a plane of the substrate 82 (specifically any of the planes perpendicular to the surface of the substrate).

**Regarding claim 23,** note that in the embodiment disclosed in FIG. 26 and paragraphs [0233] the filament structures 111 are electrodes that extend into the pores.

**Regarding claim 24,** note that the above described method of claim 15, creates a structure with all the limitations of this claim.

**Regarding claim 25,** note that the above described method of claim 18, creates a structure with all the limitations of this claim.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Iwasaki* in view of Shaffer et al. (W002/092506) (*Shaffer* hereinafter).

**Regarding claim 11,** *Iwasaki* discloses all of the limitations of claim 1, but discloses that the cobalt catalyst is deposited in the pores by electrochemical deposition rather than chemical vapor deposition.

*Shaffer* discloses a method of creating nanotubes that includes deposing a cobalt catalyst (page 5, lines 17-20, and the WIPO abstract) on an alumina substrate (page 7, line 3) by using a precursor gas (page 6, lines 12-13) that decomposes on the substrate to form the catalyst (WIPO abstract). Though *Shaffer* discloses that the substrate

particles are dispersed in the reaction gas which is a mixture of the catalyst and nanotubes precursors, one of ordinary skill in the art at the time of the invention would have realized that the method would work on larger alumina substrates and it the catalyst precursor gas does not need to be mixed with the nanotubes precursor gas.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the technique of depositing the catalyst as disclosed by *Shaffer* in place of the technique disclosed by *Iwasaki* because the simple substitution of one known element for another would have yielded predictable results at the time of the invention.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Iwasaki* in view of Du et al. (CN 1278024, DERWENT entry and machine translation included) (*Du* hereinafter).

**Regarding claim 6,** *Iwasaki* discloses all of the limitations of claim 1, but does not disclose that the nanoporous membrane is made by the anodization of a single crystal substrate.

*Du* discloses a method of forming a large-area ordered nanometer template on a single-crystal aluminum substrate (NOVELTY portion of the DERWENT abstract). *Du* also discloses that using a single-crystal aluminum substrate removes the influence of grain boundaries on the product (see the 4th paragraph of the machine translation).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form the nanoporous membrane of *Iwasaki* by anodic oxidation of a single crystal substrate.

One of ordinary skill in the art would be motivated to do this in order to remove the influence of grain boundaries on the aluminum oxide template.

### *Response to Arguments*

Applicant's amendments with respect to the specification and drawings have overcome all of the objections but one to the specification and drawings and those objections are hereby withdrawn. The remaining objection (to FIG. 4 of the drawing) is repeated above.

Applicant's arguments with respect to claims 1-25 have been considered but are moot in view of the new ground(s) of rejection.

### *Conclusion*

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The prior art, in addition to the references previously listed, is:

Choi et al. (US 6,855,603), especially FIG. 4B, which teaches a FET structure made of nanotubes;

Zhang et al. (US PGPUB 2003/0010971), which teaches the use of opened bottomed nanoporous anodized aluminum oxide templates with barrier layers between the substrate and the template;

Chen et al. (US 7,323,218), which discloses attaching a prefabricated nanoporous anodic alumina template on a substrate for the purposes of forming nanostructures;

Lee et al. (US 6,605,535), which discloses a method of growing silicon structures using a gold catalyst;

Graham et al. (US PGPUB 2004/0232426), which teaches a device that uses nanostructures oriented parallel to the plane of the upper surface of the substrate and the use of barrier layers to protect the catalyst from diffusion; and

Moskovits et al. (US 6,129,901), which discloses the basic anodized template method of forming carbon nanotubes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DAREN WOLVERTON whose telephone number is (571) 270-5784. The examiner can normally be reached on Monday to Thursday from 9:30 a.m. to 3:00 p.m., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Landau can be reached on (571) 272-1731. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. W./
Examiner, Art Unit 2813

/Matthew C. Landau/
Supervisory Patent Examiner, Art Unit 2813

DW